Deep-sea Spy: an on-line image annotation tool for citizen scientists

As a researcher, Marjolaine Matabos shares her time between the Deep-Sea Laboratory based at IFREMER in Brest and the EMSO research infrastructure. She noticeably focuses on the study of deep-sea ecosystems temporal dynamics. Studying a wide range of ecosystems from fjords to deep-sea hydrothermal vents, she relies on seafloor observatories to understand how environmental conditions shape benthic communities.

Research within the Deep Sea laboratory at Ifremer (Brest, France) focuses on deep-sea ecosystems, including hydrothermal systems and their associated fauna.

Such hydrothermal vents form in active volcanic areas where, hot fluids exit from the ocean floor, much like geysers and hot springs on land. The animal community thriving in this specific environment is of particular interest to the scientific community because of its coping mechanisms amidhigh temperatures, low oxygen concentrations and high concentrations of sulphides otherwise lethal to all other living organisms, radionuclides and heavy metals.

Due to the remoteness of such ecosystems, current knowledge was entirely based on punctual --at best yearly -- oceanographic cruises. Thanks to technological developments, we can now continuously monitor such animals, using video cameras deployed across deep-sea observatories. Since its first deployment in 2010, the TEMPO/TEMPO-mini ecological module designed by Ifremer1 acquired more than 4TB of video data (780 hours of images per year) from both the Atlantic and the Pacific deep-sea environment. that cannot possibly be analysed by few researchers. The information contained in those images would prove essential to our understanding of the biology and functioning of these peculiar ecosystems, their analysis requires far more researchers than can be mobilized by Ifremer.

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While this massive imagery archive grows by the day, its processing calls for the involvement of citizen scientists.

In order to involve citizens in the processing of deep-sea vent imagery, Ifremer joined fellow ENVRIplus infrastructure Noveltis based in Labège (France) in designing a gamified online image annotation tool. Researchers indeed gained from citizens' participation in terms of the information at the root of their scientific knowledge and citizens stand to learn and discover deep-sea vent ecosystems and their associated species, while contributing to science. Citizens may also improve their scientific observer skills by increasing their player levels through a series of quiz. At each level, a virtual 3D reward is unlocked and the user is invited to annotate additional species.

A first version of the game is undergoing a test phase that will end in January 2017. All beta-testers involved will be required to answer an anonymous questionnaire to assess the ergonomic and attractiveness of the application. Feedback will help improve the product before its official launch scheduled for next Spring, both at the national and international level.

The team is currently working with the French education system locally and the Océanopolis Center for Ocean Discovery in Brest, to reach out to teachers and students, through schools programs, but also to the general public by means of thematic exhibitions.

Crowdsourcing or 'virtual citizen science' benefits from the large-scale replication of the same tasks by thousands of people, generating statistics to improve the quality of its results 2,3. Engaging the public in data analysis will ultimately benefit marine conservation, by increasing awareness of the wealth as well as the vulnerability of deep-sea ecosystems. A sustainable collaboration with schools and associations is key in reaching out to young people and thus contributing to further develop ocean literacy 4.
Development of the on-line image annotation tool has been supported by the ENVRIplus WP14 focusing on Citizen Observatories and Participative Science.

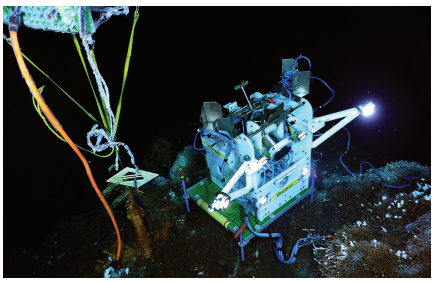

Figure 1 -Ecological module TEMPO-mini in Grotto site (Juan de Fuca ridge). © ONC/CSSF

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Figure 2 - Deep-Sea Spy game. Top left: connection page at the surface. Top right: the midwaters mission and profile level. Bottom left: annotation interface on the seafloor. Bottom right: an example of a 3D reward. © Ifremer